ON THE FORMATION MECHANISM OF FORWARD-ANGLE PRODUCTS IN THE REACTIONS ^{18}O(35 MeV/u) + ^{181}Ta(^{9}Be)

V.P. Aleshin[1], A.G. Artukh[*, 2] and Yu.M. Sereda[2]

[1]*Institute for Nuclear Research, Kiev, Ukraine*
[2]*Flerov Laboratory of Nuclear Reactions, Joint Institute for Nuclear Research, 141980, Dubna, Russia*

In order to study the production mechanisms of exotic nuclei in the Fermi-energy domain, the forward-angle (0°-2.5°) yields of $2 < Z < 11$ isotopes produced in the reactions ^{18}O(35 MeV/u) + ^{181}Ta(^{9}Be) were measured in[1, 2] using the in-flight separator COMBAS[3] in a spectrometry mode. The velocity, isotopic, and element distributions were obtained. The most striking feature of the velocity spectra $\sigma^{(Z,N)}(V,0^{\circ})$ with $6 \le Z+N < 18$, is that all they have a maximum at the projectile velocity $V=V_p$, which broadens with increasing number of removed nucleons. For ejectiles close to ^{18}O and for neutron drip line isotopes, the velocity spectra are approximately symmetric with respect to $V=V_p$, while for $Z \approx N$ and for proton-rich products the low-velocity part ($V<V_p$) of the spectra is much broader than the high-velocity one ($V>V_p$).

These properties of $\sigma^{(Z,N)}(V,0^{\circ})$ suggest an idea that zero-angle products lighter than projectile, emerge in multi-nucleon removals from ^{18}O. To verify this hypothesis, we designed a computer code MNR+FD, whose first part (MNR) simulates the removal of nucleons from *s-, p-, d*-shells of ^{18}O, while the second one (FD) deals, within the Fermi's statistical model[4], with the desintegration of those primary products which have got the *s*- and/or *p*-holes in their ground-state shell-model configurations. The nucleon removal probabilities are calculated in the framework of the semiclassical procedure[5, 6] in which the rate of removal per unit time is identified with $2|W|/\hbar$, where W is the imaginary part of the nucleon-target optical potential. Despite its simplicity, the MNR+FD code reasonably reproduces experimental zero-angle velocity distributions in the reactions of study as well as the relative yields of zero-angle products, including those near the neutron drip line.

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[*] Corresponding author, E-mail address: artukh@jinr.ru